YAMATAKE Specification

Harmonas-FLeX Distributed controller (FLC)

1. Introduction

The FLC is a compact controller designed with an eye towards installation in a board. The FLC has the following functions and features:

■Control

- The FLC has functions equivalent to those of a full-scale process controller.
  It can be used for executing both PID control and sequence control and it is provided with various functions.
- Program creation and maintenance can be performed with the integrated engineering environment RTC. Debugging can be performed easily by conducting virtual simulation on a personal computer.
- Programs can be displayed with charts using the logic block and function block for easy observation.
  Created programs can be displayed in the form of drawings.

■Installation

Compact type controller that can be installed in a small-size standard board (400 × 400).
Mountable on an existing self-standing board or wall-hang board.

- Built-in external wiring terminal board, cable connecting the input/output card with the terminal board, power supply wiring for field device signal and short protection circuit.
  As it can be connected directly with the field wiring, installation is completed by just installing FLC and connecting the power supply with the field wiring.
- 368 input/output points at the maximum (approximately 256 points with a usual combination).
  Various types can be combined in accordance with the application.
- Environment-endurable design that allows operation in an encapsulated board.

■System Compatibility

- Redundant controlling Ethernet is equipped for standard specifications.
- A programmable indicator [EST555Z] can be connected to perform graphic monitoring and collecting and storing data. This system can be used as a digital recorder.
- Developable to a system such as the cooperative automation system Harmonas by connecting a controlling Ethernet cable. The FLC can be introduced for each local board individually, making stepwise networking and systemization possible.

Note: Refer to CP-SS-1800 for the specification sheet of the programmable indicator "EST555Z," and to CP-SS-1700 for that of the "EST240Z."

Figure 1. Example of Installation in a Board

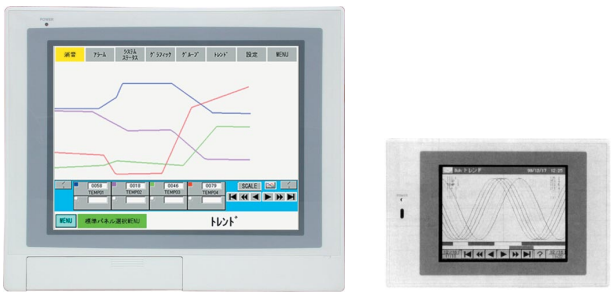


Figure 2. EST555Z/EST240Z

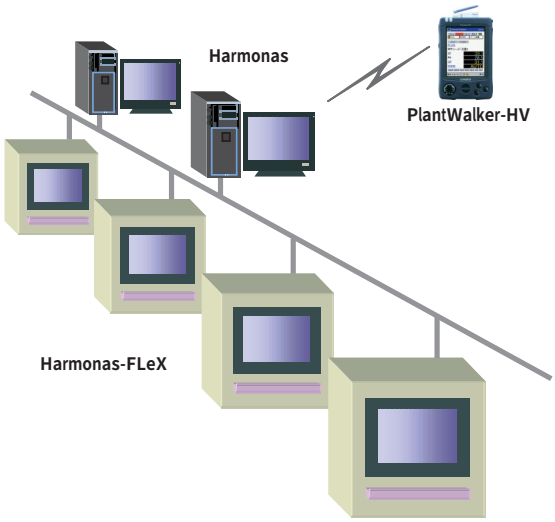


Figure 3. ISystem Architecture

2. Functional Overview

The FLC consists of a main unit and three expansion units at the maximum, and each unit has 6 I/O slots to mount I/O cards. When using an expansion unit, mount an interface card for the expansion unit to an I/O slot of the main unit, and mount similarly an interface card for interfacing with the main unit to each expansion unit, and connect them with a dedicated cable. The remaining I/O cards can be combined with the following cards of the necessary number and mounted.

- AI [4 - 20 mA/1 - 5 VDC] : 8 points/card
- AO [4 - 20 mA] : 8 points/card
- RTD : 8 points/card
- DI : 16 points/card
- DO [Semiconductor output] : 16 points/card
- DO [Relay output] : 16 points/card
  (In relay output, one card occupies two slots.)
- Indicator I/F : 1 port/card (Mounted to the main unit.)

In addition, Ethernet is adopted for the control network and connection to other systems, and information systems such as the cooperative automation system Harmonas can be made easily. The control network is provided with a dual port for the standard specification.

■ Specifications

Table 1. Hardware Specifications

Item	Specifications
CPU	32 bits
Number of I/O points	Largest configuration when three expansion units are connected - 23 I/O cards at the maximum (When the EST is connected, 22 cards at the maximum.) - HLAI: 184 points (maximum), 8 points/card - AO: 184 points (maximum), 8 points/card - DI: 368 points (maximum), 16 points/card - DO: 368 points (maximum), 16 points/card - RTD AI for room temperature: 184 points (maximum), 8 points/card, fixed range of - 20 to 80˚C Note: The maximum number of points shown above is the restriction for the mounted slots when three expansion base units are connected. A certain restriction on the number of cards for practical use may be given from the control functional performance point of view. Configuration with only the main unit - 6 I/O cards (5 cards if the EST is connected.)

Table 2. Specifications for Communication

Item	Specifications
Host communication (Harmonas system, etc.)	Ethernet 10 Mbps, 400 PPS at the maximum (parameter/second: 400 PPS in total with communication between controllers)
Communication between controllers	Available through Ethernet, 400 PPS at the maximum (parameter/second: 400 PPS in total with host communication)
I/O communication	Dedicated parallel bus
Local indicator (EST) communication	(An I/O slot of the main unit is occupied for the interface with the expansion units. No occupancy on the expansion unit side.) 1:1 communication with the controller through RS232 or RS485 Models that can be connected are EST555Z and EST240Z. (An I/O slot of the main unit is occupied for the interface.)

Table 3. Software Specifications

Item	Specifications
Adjustment control point	Adjustment control point: 32 points Adjustment PV point: 32 points
Adjustment control algorithm	19 types (48 formulas)
Control cycle	Select the basic cycle from 0.1, 0.2, 0.5 and 1 second (CL is fixed to 1 second.) Partly, 0.1 second execution processing is possible (CL is also possible.)
Sequence	128 (Maximum) 6080 MU: 18240 - 24480 statements (The CL memory has no relation with other functions and can be used as a dedicated memory.)
Logic	64 points 1024 blocks at the maximum 25 algorithms
SAMA function block	128 points at the maximum 2048 blocks at the maximum 91 algorithms (When monitoring from the DOSS/HSS is necessary, it is allocated to the numeric value variable or the flag variable.)
Digital composite	256 points at the maximum
Numeric value variable	8192(Note 1) + (80 (number of sequences used)
Flag variable	8192(Note 2) + (128 (number of sequences used)
Timer variable	32 points

Note 1: 3,000 points are for use by the user, and the rest is reserved for the system.
Note 2: 3,000 points (including 512 for alarm) are for use by the user, and the rest is reserved for the system.

■Installation environment conditions

Installation environment conditions for a single installation are shown in the following table. For a single installation, provide clearances of the specified dimensions around the main unit.

In addition to the following conditions, pay appropriate attention to the external magnetic field, electrostatic discharge, radio interference, etc.

Table 4. Installation Environment Conditions

Item		Standard operating conditions	Normal operating conditions	Marginal operating conditions	Conditions for storage and transportation
Ambient temperature (Note 1)	Range (℃)	23± 2	0 to 50	0 to 50	0 to 50
	Rate of change (℃/h)	± 5	± 20	± 20	-
Relative humidity	(% RH)	50 ± 10	5 to 95 (0.020kg/kg')Note2	5 to 95 (0.020kg/kg')	5 to 95 (0.020kg/kg')
Vibration (Note 3)	Amplitude	0	0.35 mm or lower (2 to 9 Hz)	0.35 mm or lower (2 to 9 Hz)	1.5 mm or lower (2 to 9 Hz)
	Acceleration	0	1m/s² mm or lower (9 to 150 Hz)	1m/s² mm or lower (9 to 150 Hz)	5m/s² mm or lower (9 to 150 Hz)

Note 1: The atmosphere for use shall not include any corrosive gas. It is recommended to install in the control panel with a temperature of 45 ℃ or lower.
Note 2: Maximum relative humidity (ratio of mass, kg/kg between wet air and dry air)
Note 3: Do not install in a place in which strong vibration is applied continuously.

■Input and output specifications

Table 5-1. Input and Output Specifications

Item		Specifications
Analog input specifications	Number of points	8 points/card
	Input power supply voltage and consumption current	24 VDC (10%, 70 mA (When the transmitter* power supply is not used.)
	Input signal	1 to 5 VDC (0 to 100%)
	Input range (FS)	0.726 to 5.276 VDC (- 6.9 to 106.9%)
	Accuracy	0.5% F.S. (factory-shipped adjustment, under the environment of 25 ℃ ±2 ℃)
	Repeatability	0.5% F.S.
	Insulation	Common insulation with the input power supply and system power supply Differential input for use between channels (allowable operating voltage ± 3 V)
	Input impedance	1 MΩ or higher
	Transmitter power supply	18.6 to 26.4 VDC, 200 mA or more at the maximum (8 points, prepared for each common card)
Temperature input (Room temperature, outside air temperature, etc.)	Number of points	8 points
	Input power supply voltage and consumption current	24 VDC ±10%, 70 mA
	Input signal	PT 100 Ω, New JIS - 20 to 80℃ , fixed range
	Accuracy	1% F.S. (under the environment of 25 ℃ ±2 ℃)
	Insulation	Common insulation with the input power supply and system power supply
	Allowable wiring resistance	5 Ω or lower
Analog output	Number of points	8 points/card
	Output power supply voltage and consumption current	24 VDC ±10%, 140 mA (at 100% output on all points)
	Output range	4 to 20 mA (0 to 100%)
	Output scope	2.9 to 21.1 mA (- 6.9% to 106.9%)
	Accuracy	0.5% F.S. (factory-shipped adjustment, under the environment of 25 ℃ ±2 ℃)
	Repeatability	0.5% F.S.
	Insulation	Common insulation with the input power supply and system power supply
	Maximum load resistance	300 Ω
Digital input	Number of points	16 points/card
	Input circuit	Photocoupler input (selectable for each source, or sink or card)
	Common	16 points common
	Input power supply voltage and consumption current	24 VDC ±10%, 100 mA (When all points are ON.)
	Input signal	ON: 18 V or higher (2.4 mA or higher)
		OFF: 6 V or lower (0.8 mA or lower)
	Input impedance	6.8 kΩ
	Input filter time constant	10 ms
	Insulation	Insulated from the system power supply and not insulated from input power supply
	Input type	Status-type, or latch-type (push button) input or counter-type Specifiable for each point (depending on the software)
	Latch type DI input detection width	100 ms or more
	Integratable pulse width	100 ms or more (200 ms or higher at ON/OFF)

*Remarks: The transmitter power supply is not insulated from the input power supply.
When the transmitter power supply is used, the input side becomes common and differential input cannot be performed.
When connecting a two-wire transmitter or 4 to 20 mA input, install a 250 (resistor to the external terminal.

Table 5-2. Input and Output Specifications (Continued)

Item		Specifications
Digital output	Number of points	16 points/card
	Output circuit	Open collector
	Common	16 points common
	Output power supply voltage and consumption current	24 VDC ±10%, 10 mA (When all points are OFF.)
	Maximum key current (load current)	Maximum 0.5 A (for one point)
		Maximum 2 A (for one card)
	Output transistor ON voltage	1.5 V or lower (When the load current is 0.5 A.)
	Insulation	Insulated from the system power supply and not insulated from the output power supply
	Output type	Latch-type (status) output or pulse-type output, specifiable for output of each point
		(Depending on the software)
	Pulse-type DO pulse width	100 ms to 120 s, 100 ms resolution
Digital output (When a relay terminal panel is used.)	Number of points	16 points/card
	Output circuit	Make (A contact)× 16 points
	Output power supply voltage and consumption current	24 VDC ±10 %, approximately 150 mA (When relay 16 points excited)
	Contact rating	250 VAC 2A (resistance load)
		30 VDC 2A (resistance load)
	Operating time	10 ms or less
	Reset time	5 ms or less
	Output transistor leak current	1.5 V or lower (with 24 VDC)
	Insulation	Insulated from system power supply and output power supply
	Output type, pulse width	Same as open collector output

■ Model

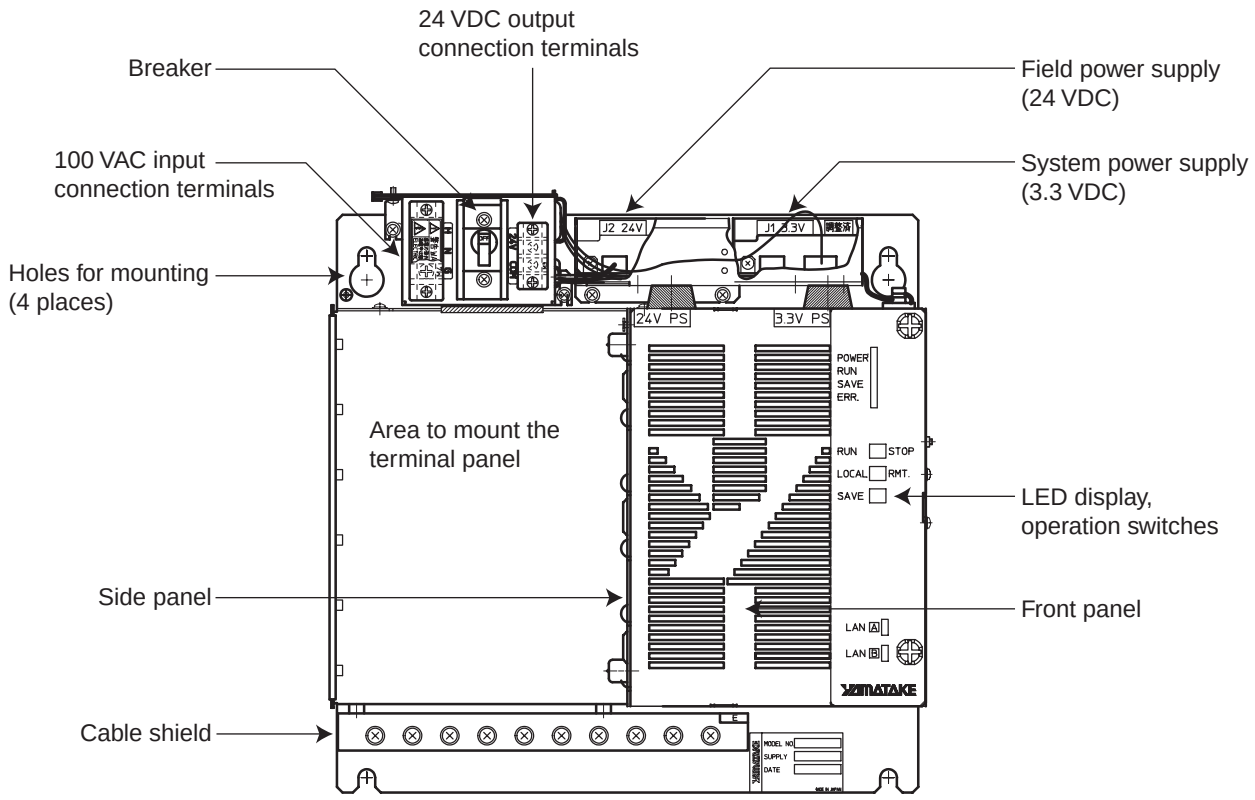
Table 6. List of Models

varnish finished	Model	Name	Remarks
*	HD-FXFLC00P	Main unit: With field power supply	Controller/main unit (Either one shall be selected.)
*	HD-FXFLC00PE	Main unit: With field power supply + With expansion unit I/F board	
*	HD-FXFLC00N	Main unit: Without field power supply	
*	HD-FXFLC00NE	Main unit: Without field power supply + With expansion unit I/F board	
	HD-FXSWFLC20	FLC license	Necessary for each main unit
*	HD-FXFLE00P	Expansion unit: With field power supply	Controller/expansion unit (Either one shall be selected.)
*	HD-FXFLE00N	Expansion unit: Without field power supply	
*	HD-FXDCBX00	Expansion unit I/F board (3 ports on the main unit side)	Necessary when connecting an expansion unit to the main unit without an expansion unit I/F
	HD-FXEXPNL	Front panel for connecting the expansion unit (A part on the main unit side)	
	HD-FXCBL01	Expansion unit connection cable: 1 m	Necessary when expanding the input/output
	HD-FXCBL02	Expansion unit connection cable: 2 m	
	HD-FXCBL03	Expansion unit connection cable: 3 m	
*	HD-FXAIPS00	Analog input card (with terminals)	Input/output card
*	HD-FXRTDPS0	Temperature measuring resistor card (Air conditioning specifications: - 20℃ to 80℃ , with terminals)	
*	HD-FXAOPS00	Analog output card (with terminals)	
*	HD-FXDIPS00	Digital input card (with terminals)	
*	HD-FXDOPS00	Digital output card (SS output, with terminals)	
*	HD-FXDYPS00	Digital output card (with relay terminals)	
*	HD-FXESTS00	EST smart terminal I/F card	Necessary when connecting the EST
	HD-FXWMCAB0S	Standard board (S size): Wall-hang board type: for installing EST240Z	
	HD-FXWMCAB0M	Standard board (M size): Wall-hang board type: for installing EST555Z	
	HD-FXWMCAB0L	Standard board (L size): Freestanding board type: for installing EST555Z	
	HD-FXSWRTCF	RTC_FLEX (software)	

* : For varnish finished products, a "C" is affixed to the end of the model number.

■ Functions of each part

Names of each part are shown in Figure 4.



Note 1: Wiring for 3.3V power supply for the controller is completed.
Note 2: Connect the field 24 V power supply (2.2 A) to the feeder terminal on the specified terminal panel for each I/O module.

Figure 4. Name of each Part of the FLC

Functions of the display unit are as follows:

- POWER : Lights up when the power supply of the communication control unit is normal.
- RUN : Lights up while the control is being executed.
- SAVE : Lights up when the control database exists in the flash memory. Flashes during saving.
- ERR. : Flashes when any error occurs.

Functions of the operating unit are as follows:

- RUN/STOP : Starts/stops the control and brings the system into idling status.
- LOCAL/RMT. : Switches to the LOCAL side when operating control start and stop with the above-mentioned switch; switches to the RMT. side when operating through the RTC.
- SAVE : Executes saving. Move the switch to the left and continue to hold it there until the SAVE LED starts to flash. When the switch is released, it returns to the right.

3. Control Functions

Control functions are classified into the following control points:

■ Regulatory PV Point (RegPV)

Standard I/O processing functions, like industrial unit conversion and alarm, are directly carried out by using I/O monitoring. The regulatory PV point achieves the process variable (PV) calculation and compensation functions. Algorithms such as flow rate compensation, integration and variable dead time compensation implement PV processing. It is available to provide more enhanced configuration such as alarm suppression, signal filtering, etc. Signal filtering, algorithm and calculation formula options.

For available algorithm and other supported functions, see Table 7.

Table 7. Regulatory PV Points

Available algorithm	Support function
Data acquisition	PV source(Automation, manual, substitution)
Flow rate compensation	PV clamp
Middle of three	Engineering unit conversion and extended PV range check
High/low/average selector	PV status
Summer	PV filtering
Integration (totalizer)	PV alarm
Variable dead time	- Bad PV
Lead/lag compensation	- Upper and lower limits of PV
General linearization	- Upper-upper/Lower-lower limits of PV
Calculator algorithm	- PV rate of change alarm

■ Regulatory Control Point (Reg Ctl)

Regulatory control points are used to carry out the control functions of FLC. Configuration of the algorithms listed in Table 8 carries out the regulatory control point functions. Each algorithm contains configurable options and achieves complicated control by a simple menu selection. Functions provided as standard functions include initialization and windup protection. The set point lamping (by operator entry of target values and lamp time) is also configurable.

Table 8. Adjustment Control Points

Available algorithm	Support function
PID	Mode/mode attribute
With PID field forward	Red tag
With PID external feedback	Initialization
Position proportion on/off control	Windup protection
Ratio control	External mode switchover
Lamp/soak	Safety cutoff
Automatic/manual station	Limit (output)
Speed type addition	PV source
Switch	PV alarm
Override selector	- Bad PV
	- Upper and lower limits of PV
	- Upper-upper/Lower-lower limits of PV
	- PV rate of change alarm

■ Digital Composite Point (Dig Comp)

Digital composite points are multi input and multi output points that provides interface to discrete equipment, like the motors, pumps and solenoid valves. These points provide interlock processing functions as standard functions. These points can also display interlock states on the screen of an open supervisory station. The displayed states have information effective for tracking the cause of interlock. The " / local / hand / off / auto / " switches generally used for motor driving equipment can also be handled. Figure 5 shows the major parameters related to this type of control point.

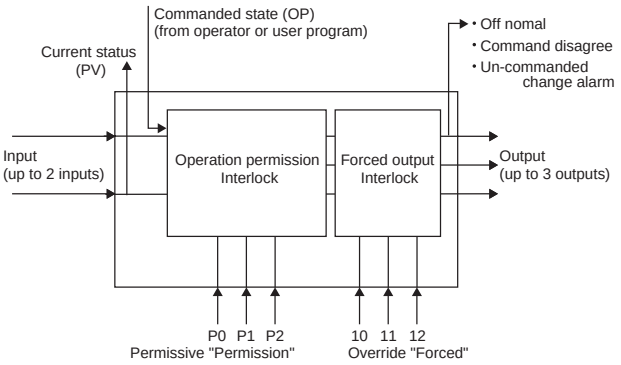


Figure 5. Structure of Digital Composite Points

■ Logic Point (Logic)

Logic points are used together with digital composite points to provide interlock logic functions.

A logic point has a processing equivalent of up to two pages of relay ladder logic.

A logic point consists of a logic block, flag, numeric value variable, input connection and output connection. Three are three types of combinations in configuration of inputs, outputs, and logic block of a logic points. (See Table 9)

In addition to the logic block functions, logic points are available as data transfer points. This reads data from input connections and makes an output connection of this data, so that the data can be transferred to a parameter of other defined databases.

Table 9. Maximum Configuration Example of Logic Points

Configuration / Type	Input	Output	Logic block
Option 1	12	4	16
Option 2	12	8	8
Option 3	12	12	0

Note: Each logic point provides six status flags, six user flags and four numeric value variables.

Table 10. Logic Block Algorithm

Logic	AND
	OR
	NOT
	NAND
	NOR
	XOR
	QUALIFIED-OR 2 (2-input majority decision)
	QUALIFIED-OR3 (3-input majority decision)
Comparison	EQ (= with dead band)
	NE (≠ with dead band)
	GT (> with dead band)
	LT (< with dead band)
	LE (≤ dead hand)
Delay	DELAY
	ON DELAY
	OFF DELAY
Pulse	FIXPLS (fixed length pulse)
	MAXPLS (maximum time limit pulse)
	MINPLS (minimum time limit pulse)
Watch dog timer	WATCHIDOG
Flip flop	FLIPFLOP
Input error check	CHECKBAD
Switch	SWITCH
Change detection	CHDETECT

Note: AND, OR, NAND and NOR gates accept three inputs per block. Options are available to inverse inputs.

■ Function Block Point (FB)

Function block point consists of 91 types of function blocks (see Table 11). Up to 2048 function blocks are available per point. Conforming to a block notation system called SAMA (Scientific Apparatus Makers Association), these function blocks can construct control functions by a logic diagram system.

Table 11. Function Block Algorithm

Arithmetic operation (8 types)	ADD (addition)	SUB (subtraction)	MUL (multiplication)	DIV (division)
	MOD (modulo)	EXPT (exponent xy)	SUM (4-point addition)	DADD (digital addition)
Single number value variable (13 types)	ABS (absolute value)	SQR (square)	SQRT (square root)	LN (logarithm natural)
	LOG (customary logarithm)	EXP (exponent ex)	SIN (sine)	COS (cosine)
	TAN (tangent)	ATAN (arctangent)	TRUNC (truncation)	ROUND (rounding)
	PSQRT (percent square root)			
Selection (9 types)	MAX (maximum value)	MIN (minimum value)	AVG (average value)	
	HSE (high selector)	LSE (low selector)	MID3 (middle of three)	
	SW (switch)	SFT (softening switch)	ALSW (alternate switch)	
Detection (12 types)	HLM (high limiter)	LLM (low limiter)	DRL (rate-of-change limiter)	HMS (high monitor)
	LMS (low monitor)	DRM (rate-of-change monitor)	DMS (deviation monitor)	NUMCHK (normality check)
	BADCHK (badness check)	INFCHK (infinity check)	QLTCHK (change check 1)	CHGCHK (change check 2)
Conversion (4 types)	PTE (EU value conversion)	ETP (% conversion)	FUNC (function conversion)	CONV (data type conversion)
Logical operation (11 types)	AND (logical product)	OR (logical sum)	NOT (inversion)	NAND (inverted logical product)
	NOR (inverted logical sum)	XOR (exclusive logical sum)	QOR2 (2-input majority decision)	SR (set)
	RS (reset)	ORIN4 (4-input logical sum)	ANDIN4 (4-input logical product)	
Comparison (6 types)	EQ (= with dead band)	NE (≠with dead band)	GT (> with dead band)	
	GE (≥with dead band)	LT (< with dead band)	LE (≤dead band)	
Pulse (3 types)	FIXPLS (fixed length pulse)	MAXPLS (maximum time limit pulse)	MINPLS (minimum time limit pulse)	
Timer (5 types)	CYCPLS (timer)	WDT (watch dog timer)	DELAY (delay)	ONDLY (on delay)
	OFFDLY (off delay)			
Counter (4 types)	UCNT (up counter)	DCNT (down counter)	AAV (analog integration)	PAV (pulse integration)
Control operation (8 types)	PID (PID operation)	PRO (proportion)	INT (integration)	DIF (differentiation)
	LDLG (leading/delay)	DED (waste time)	TF (filtering time)	DLTPV (speed type PV)
Others (7 types)	RMP (lamp)	MAV (movement average)	ANMA (analog memory)	GW (gate way)
	SG (single)	FL (flag)	TIMFL (one shot FL)	REDTAG

■ Process Module Data Point (Proc Mod)

Process control often requires flexible control programs that are also available for continuous process, batch or hybrid applications. Process module data point is a user created program (CL program) written in special-purpose control language. This language provides powerful sequence control and calculation functions.

CL programs can access analog input and output, digital input and output, logic block status, alarm status, failure status, numeric value variables, and flags.

Process module data points provide phase, step and statement structures suitable for implementing batch process control functions. They can also activate a sequence for hold, shutdown, or emergency shutdown by means of the powerful function of the multilevel error processing.

■ Flag Point

Flag points indicate two states, such as on and off, and accepts entries of Boolean algebra values. Flag points can be changed by operators and user programs. Per FLC, 8192 flags are prepared. Of these flags, the first 512 flags support off-normal alarms (generates alarm at status on).

■ Numeric Value Variable Point

Numeric value variable points are numeric value variables that literally save real values and are effective for batch (recipe) operations. Per FLC, 8192 numeric value variable points are prepared. Like flag points, numeric value variable points are not included in the point processing schedule.

■ Timer Point

Timer points are effective for operators and user programs to supervise process events. Timer points are processed once every second. Per FLC, 32 timer points are prepared.

4. Alarm System Functions

FLC supports alarm functions. If alarms occur, these alarms are notified onto an open supervisory station via various types of screens. Alarms are generally classified into PV alarms and digital alarms.

■ PV Alarm

For access variables, configurable PV alarms are as follows. Methods are available for setting alarms in I/O points or in control points. In general, if a control point uses an I/O point, an alarm is set in a control point. Otherwise, it is set in an I/O point.

- High
- High high
- Low
- Low low
- Change rate high
- Change rate low
- Significant change

A dead band can be set in all PV alarms mentioned above.

■ Digital Alarm

Digital alarms are divided into the following three types:

- Off normal alarm
- Uncommanded change alarm
- Command disagree alarm

Off normal alarms are simply generated when the status is on. Both uncommanded change alarms and command disagree alarms are set within digital composite points and detect a disagreement between input and output. A command disagree alarm detects a disagreement between input and output just after an output change, while an uncommanded change alarm detects a disagreement between input and output when no output change is made. Both alarms can set dead band time.

■ Alarm Priority

Alarm priority can be configured for individual alarm types for each point. Selectable alarm priorities can be divided into the following five types:

- Emergent (emergency)
- Important (high)
- Ordinary (low)
- Record only (journal)
- Only journal printer output (not used when the EST is connected)
- Journal recording + printer output (not used when the EST is connected)
- None (no action)

■ Contact Cutout

The contact cutout function allows a program to temporarily stop an alarm for each point having alarm functions. The “CONTCUT” parameter, prepared for the points having alarm functions, can be set to on to put the points in the alarm stop status.

5. Processing Performances

Combining adjustment control loops, logic functions, sequence and I/O processes, FLC can configure control functions according to applications. The configuration needs to take into account restrictions on the maximum number of points per FLC, the processing unit (PU value), which is a unit of processing capability, and the memory unit (MU value), which is a permitted memory unit of CL program size.

■ Maximum Number of Points

The maximum number of points settable per FLC is as follows.

Table 12. Maximum Number of Points (per FLC)

Point type	Maximum number of points
Regulatory control	32
Regulatory PV	32
Process module	128
Logic	64
Digital composite	256
Function block	128
Numeric value variable (NN)	8,192(Note 1) + (80 (number of sequences used)
Flag variable (FL)	8,192(Note 2) + (128 (number of sequences used)
Timer variable (TM)	32
I/O point	(Number of points per module 24)

Note 1: 2,047 points are for use by the user, and the rest is reserved for the system.

Note 2: 2,047 points (including 512 for alarm) are for use by the user, and the rest is reserved for the system.

■ Maximum Number of Blocks

The following restrictions apply to the function blocks, components of function block points.

Table 13. Maximum Number of Function Blocks

Function block point Per point	2048 blocks
Per FLC	2048 blocks

■ Processing Unit (PU Value)

This unit represents the processing capability of FLC, determined based on the point types, control cycles, etc.
PU values differ depending on point types and control cycles.
The following table lists the maximum PU values per FLC and PU values at points.

Table 14. Maximum PU Value (Per FLC)

Point Type	PU value
Total of control points and function blocks and of I/O points	700

Table 15. List of PU Values of I/O Points

Device	PU Value				
		I/O Monitoring Cycle			
		1sec	0.5sec	0.2sec	0.1sec
Main unit	2.0	-			
Expansion unit (for each unit)	4.0	-			
Digital input (DI) (for each card)	-	0.7	1.1	2.3	4.3
Digital output (DO) (for each card)	-	0.2	0.4	1.0	2.0
Analog input (AI) (for each card)	-	1.5	2.2	4.3	7.8
Analog output (AO) (for each card)	-	0.3	0.6	1.5	3.0

Note: In AI, it is assumed that two alarms (occurrence or restoration) at a time occur every second in the 4 slots.
In DI, it is assumed that one off-normal alarm at a time occurs every second in the 8 slots.

Table 16. List of PU Values (Control Cycle = 1 sec)

Control Point Name	1sec PU Value
RegPV	0.8
RegCtl	1.1
Logic	0.7
DigComp	0.1
ProcMod（short）	1.0
ProcMod（long）	2.0

Function Block	1sec, PU Value	Function Block	1sec, PU Value	Function Block	1sec, PU Value
ADD	0.027	LLM	0.018	LE	0.027
SUB	0.027	DRL	0.044	FIXPLS	0.027
MUL	0.027	HMS	0.018	MAXPLS	0.027
DIV	0.027	LMS	0.018	MINPLS	0.027
MOD	0.022	DRM	0.044	CYCPLS	0.031
EXPT	0.027	DMS	0.027	WDT	0.027
SUM	0.031	NUMCHK	0.018	DELAY	0.018
DADD	0.031	BADCHK	0.018	ONDLY	0.031
ABS	0.018	INFCHK	0.018	OFFDLY	0.031
SQR	0.018	QLTCHK	0.018	UCNT	0.022
SQRT	0.018	CHGCHK	0.027	DCNT	0.022
LN	0.027	PTE	0.022	AAV	0.031
LOG	0.027	ETP	0.022	PAV	0.031
EXP	0.027	FUNC	0.031	PID	0.083
SIN	0.027	CONV	0.035	PRO	0.027
COS	0.027	AND	0.022	INT	0.053
TAN	0.027	OR	0.022	DIF	0.070
ATAN	0.027	NOT	0.022	LDLG	0.044
TRUNC	0.027	NAND	0.022	DED	0.040
ROUND	0.027	NOR	0.022	TF	0.053
PSQRT	0.018	XOR	0.022	DLTPV	0.027
MAX	0.031	QOR2	0.027	RMP	0.035
MIN	0.031	SR	0.022	MAV	0.048
AVG	0.031	RS	0.022	ANMA	0.031
HSE	0.027	ORIN4	0.031	GW	0.022
LSE	0.027	ADDIN4	0.031	SG	0.018
MID3	0.031	EQ	0.027	FL	0.018
SW	0.027	NE	0.027	TIMFL	0.031
SFT	0.044	GT	0.027	REDTAG	0.018
ALSW	0.022	GE	0.027		
HLM	0.018	LT	0.027		

■ Memory Unit (MU Value)

Memory unit value is a unit value indication that helps user in using memory of FLC, this determines the total size of CL programs. Memory unit values are used to store CL programs themselves. For MU value calculation, a CL program is divided into three statements. An MU value is then found by the quantity of statements. Each division is called a CL block, with 1CL block = 1 MU. The maximum MU value per FLC is 6080.
Different from PU values, MU values are not affected by control cycles or the number of I/O points.

■ Control Cycle

Control cycles are selectable per FLC from among 1 sec, 500 msec, 200 msec and 100 msec (for combinations, see Table 17). In addition to the control cycles, some of the data points can be processed at high speed (100 ms) by means of fast scan function.

Table 17. Combination of Control Cycles

SCANRATE Parameter	Point Type			
	RegcTl, RegPV	Logic, DigComp	PromMod	FB
Reg1 Log1	1sec	1sec	1sec	Selection of the following control cycles per point ・1sec ・500msec ・200msec ・100msec
Reg1 Log2	1sec	500msec	1sec	
Reg1 Log5	1sec	200msec	1sec	
Reg1 Log10	1sec	100msec	1sec	
Reg2 Log2	500msec	500msec	1sec	
Reg2 Log5	500msec	200msec	1sec	
Reg2 Log10	500msec	100msec	1sec	
Reg5 Log5	200msec	200msec	1sec	
Reg5 Log10	200msec	100msec	1sec	
Reg10 Log10	100msec	100msec	1sec	
Fast scan	100msec	100msec	100msec	

6. Smart Debug

The smart debug function can check operations of various control functions and I/O processing functions provided by FLC without using I/O modules.
This function can be carried out per FLC. After the transition to the debug mode, the function neither receives inputs from I/O modules nor transmits outputs to I/O modules, except for performing controlling operations within FLC and I/O processing operation.
Engineers can set any values on FLC as virtual process data, making the debugging of CL programs, etc., easy. Engineers can operate and supervise the status of the debug mode on the Harmonized supervisory station.

7. Software Simulation

The software simulation function (option) allows standalone PCs to virtually carry out functions of FLC. Using this function enables creating and verifying (debugging) applications in an environment without actual machines. One PC can perform those operations for more than one FLC.

8. Restart

The FLC restarts operation based on data from the flash memory on the CPU card (CTC) at a time of normal restart. It is designed so that, at restart, the necessary startup operations become minimal, while the status of the process is maintained.
The control loop performing output to the field is switched into the manual mode, and the sequence can be selected from among automatic start from the beginning, stop at the first step, or stop at the last execution position.
Data save to the flash memory can be manually performed with switches on the front panel of the controller or on the local indicator.

9. Connection of the expansion base units

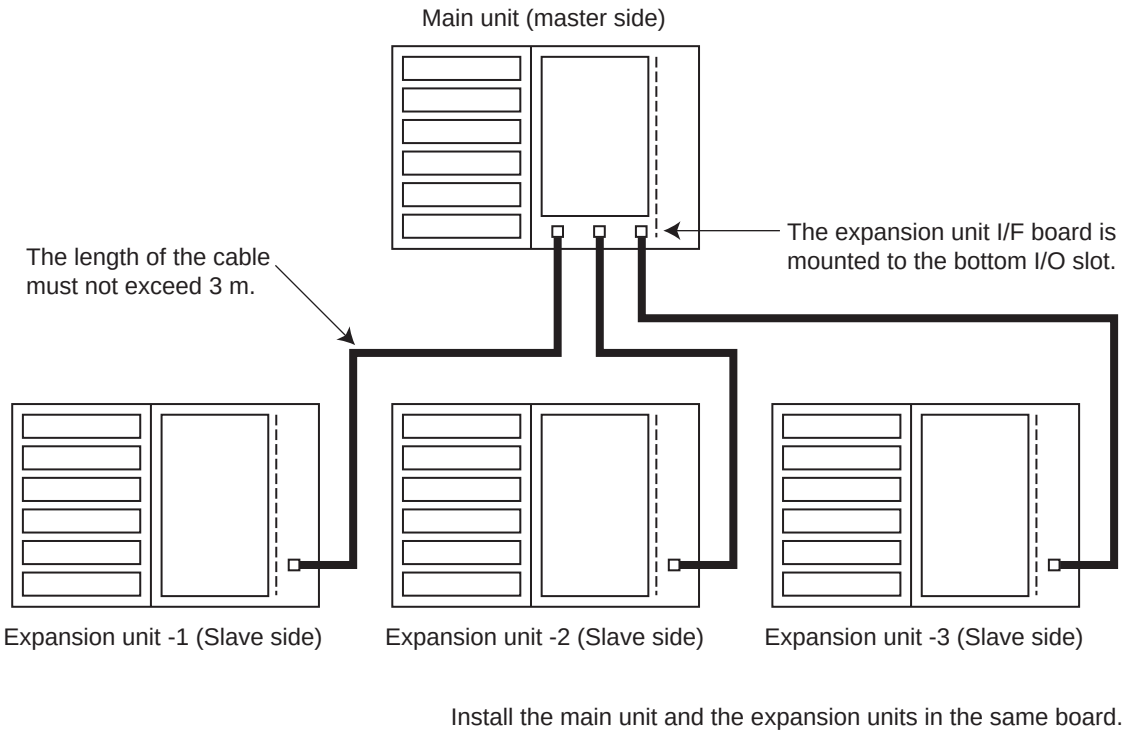
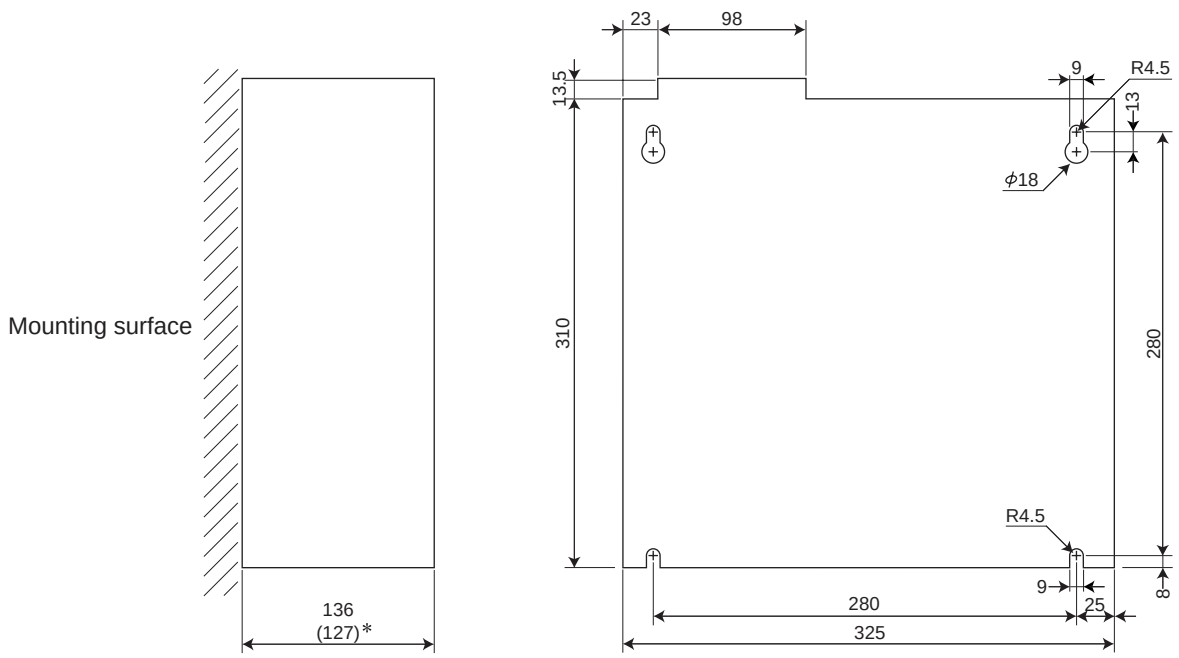

Main unit (master side)
The expansion unit I/F board is mounted to the bottom I/O slot.
The length of the cable must not exceed 3 m.
Expansion unit -1 (Slave side)
Expansion unit -2 (Slave side)
Expansion unit -3 (Slave side)
Install the main unit and the expansion units in the same board.

Figure 6. Diagram for Connection of the Expansion Base Unit

10. Outer Dimensional Drawing



*: The figure in the brackets is for models without the field power supply (24 V)

Figure 7. FLC Outer Dimensional Drawing

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